PF2200 - DB

Modbus Configuration Guide

DOC-001117

v2.0

PROFIRE

CONTENTS

1 CONFIGURATION

This document outlines configuration details for using Modbus with the PF2200-DB BMS and is applicable for the following hardware and firmware versions:

BMS Card Hardware Version	UI Card Hardware Version	PF2200-DB Firmware Version
v2.3.x / v2.4.x	v3.2.x / v3.3.x	DB 2.0.4

The protocol used is Modbus RTU as a slave device and the physical implementation is half-duplex RS-485.

1.1 PF2200 MODBUS CONFIGURATION SETTINGS

Navigate to the Modbus Menu (Settings > Setup > Modbus) on the PF2200 User Interface to configure the following settings:

Name	Default	Options	Description
Modbus RTU Communication	Disabled	Disabled Enabled	Enables or disables the Modbus port on the User Interface Card. This must be enabled to utilize Modbus functionality.
Modbus Termination	Disabled	Disabled Enabled	Enables or disables a 100 Ω termination resistor across the A and B signal lines. This should be enabled if this device is the last drop on the Modbus line.
Baud Rate	9600	9600 19200	Baud rate of the communication protocol. 9600 should be used for noisy or long run lengths.
Stop Bits	1	1 2	Number of stop bits used for Modbus communication.
Parity	None	None Odd Even	Parity bit used for Modbus communication.
Slave Address	1	1 - 247	Modbus slave address of the PF2200. Ensure that the address is not used by any other devices on the Modbus line.

1.2 MODBUS MASTER CONFIGURATION REQUIREMENTS

Ensure that Modbus Master device is configured as follows:

Name	Requirement	Notes
Baud Rate	As desired	Must match the Baud Rate setting configured on the PF2200 above.
Stop Bits	As desired	Must match the Stop Bits setting configured on the PF2200 above.
Parity	As desired	Must match the Parity setting configured on the PF2200 above.
Slave Address	As desired	Must match the Slave Address setting configured on the PF2200 above.
Mode	RTU	Modbus TCP is not directly supported but can be used with a TCP/IP to RTU Gateway installed.
Minimum Interpacket Delay	20ms	
Minimum Response Timeout	500ms	The recommended response timeout is 1 second or larger.
Minimum Time Between Writes	5 seconds	It is recommended that settings be written only when changed; continuous writing of settings should be avoided.
Minimum Time Between Reads	1 second	
Multiplication Factor	As required	A “10x” in the register tables below indicates that the value returned is 10 times its actual value. Any required conversion must be done by the master device.

1.3 TROUBLESHOOTING

The following section outlines some common issues with Modbus configuration and installation.

Problem	Proposed Solutions
Device not responding	• Ensure configuration parameters match between the master device and the PF2200. • Ensure RS-485 lines are connected properly – The A wire connects to A or D- and the B wire connects to B or D+. • Ensure the PF2200 Modbus RTU Communication setting is set to "Enabled". • Ensure a signal ground wire is connected between the master and slave device. • Raise the response timeout on the master device. • Toggle the PF2200 Modbus Termination setting and retry. A termination resistor can cause the master device to be incorrectly biased in some cases. • Confirm that the master device has internal pullup and pulldown termination on the data lines as some devices require external biasing resistors to be installed.
CRC Errors	• Ensure configuration parameters match between the master device and the PF2200. • Ensure there is no noise on the line caused by external equipment or long run lengths. • Ensure RS-485 lines are connected properly – The A wire connects to A or D- and the B wire connects to B or D+.
Data returned is always 0	• Ensure the PF2200 Modbus RTU Communication setting is set to "Enabled". • Ensure the UI is communicating with the BMS (see Communication Loss). • Ensure register address is correct.
BMS shuts down when writing setpoints	• Ensure Modbus writes are correctly formatted. • Ensure master device is configured to write in the correct units for each register. • Ensure that setpoint writes are not causing configuration alarms on the PF2200 (e.g., the system will go to Lockout if the Process Setpoint is written to be higher than its configured High Temperature Setpoint. Refer to the Product Manual for additional details.
BMS will not start when Start command sent via Modbus	• Ensure the correct value is being written to the appropriate Start/Stop Register (there are separate registers to start burner A, start burner B or start both). • Ensure that no active alarms are present on the PF2200 and all on-screen lockout messages have been acknowledged at the PF2200 UI or with the Clear Shutdown Code Register.
Read values don't make sense	• Ensure that the master device is configured to read values in the units configured on the PF2200 UI • Ensure that the master device is configured to apply a 0.1 multiplication factor for any registers that are marked with a "10x" in the Modbus Register Map below.
Read values are not matching expected results	• Ensure that master device is configured with the correct data type for each register. Use the Test Registers to verify configuration. • Ensure register address (or offset – see Register Address vs. Register Offset) is correct.

1.3.1 MODBUS DIAGNOSTICS

Check the Modbus Diagnostics screen (System > Diagnostics > Modbus) for useful troubleshooting information.

Diagnostic Name	Description	Potential Cause
Received Packets	The total number of packets received without protocol error.	N/A
Transmitted Packets	The total number of packets transmitted.	N/A
Invalid Device Addresses	The number of received packets that are not addressed to this slave device.	Configured Slave Address setting is incorrect
Exceptions	The total count of illegal packet codes.	Incorrect configuration or Modbus master programming error
Illegal Function Code	The requested Modbus function code is not supported.	Modbus master programming error
Illegal Register Address	The requested register address is not supported.	Modbus master programming error
Illegal Data Value	The data written to the register is out of range, or if the register spans multiple addresses not all addresses are written to in a single write request.	Modbus master programming error
Frame Error	The received Modbus packet has frames that do not match the current configuration.	Configured Baud Rate, Parity, and/or Stop Bits settings do not match the Modbus master communication settings
Noise Error	The slave Modbus port has detected noise on the RS-485 line.	Incorrect configuration or noise from external sources.
Parity Error	The received Modbus packet has a parity failure.	Corruption, noise, or incorrect configuration
Checksum Error	The Modbus packet has been received but the CRC check has failed indicating a corrupt packet.	Noise or missed bits on the RS485 line.

1.4 MODBUS COMMANDS

The table below specifies the supported Modbus RTU commands.

Name	Command	Description
Read Input Registers	4 = 0x04	Two bytes per register are returned [1] [2]
Read Coil	1 = 0x01	Bits pack the response [1] [2]
Read Holding Registers	3 = 0x03	Two bytes per register are returned [1] [2]
Read Discrete Input	2 = 0x02	Bits pack the response [1] [2]
Write Multiple Holding Registers	16 = 0x10	Two bytes per register must be sent [1]
Write Single Holding Register	6 = 0x06	Two bytes per register must be sent [1]
Write Multiple Coils	15 = 0x0F	NOT SUPPORTED [3]
Write Single Coil	5 = 0x05	NOT SUPPORTED [3]

[1] An exception code is returned for any request to an invalid register address.
[2] Multiple-register requests return 0 for all invalid registers (rather than returning an exception code) as long as the first register has a valid address.
[3] An exception code is returned for any unsupported commands.

1.5 REGISTER ADDRESS VS REGISTER OFFSET

Some Modbus configuration software requires the 5-digit Register Address to be entered while other software uses the 1-to-4-digit Register Offset. Consult the Modbus master device manufacturer documentation to determine which is required. The Modbus Register Map displays both the address and the offset for each register.

1.6 REGISTER DATA FORMAT

The following table specifies the data types supported and indicates how controller status information is represented for each data type:

Data Type	Status Information (Hexadecimal)	Modbus Representation		Endianness
int16/ uint16	0x0A0B	0x0A0B in a single 16-bit register		Big-endian
int32/ uint32	0x0A0B0C0D	0x0A0B0C0D in two sequential 16-bit registers	0x0A0B in first register	Big-endian
			0x0C0D in second register	
Bitset	0x0000	0x0000 in a single 16-bit register where each binary digit represents separate status information	Bit 0: 0b0000 0000 0000 0000	Big-endian
			Bit 1: 0b0000 0000 0000 0000	
			⋮	
			Bit 14: 0b0000 0000 0000 0000	
			Bit 15: 0b0000 0000 0000 0000	
Array	0x0A0B0C0D0E0F	0x0F0E0D0C0B0A held in consecutive 16- bit registers	0x0F0E in first register	Little-endian
			0x0D0C in second register	
			0x0B0A in third register	

1.7 SYSTEM UNITS

Settings and status registers are represented in their respective display units as configured on the UI (Settings > Setup > Units) unless indicated.

1.8 COMMUNICATION LOSS

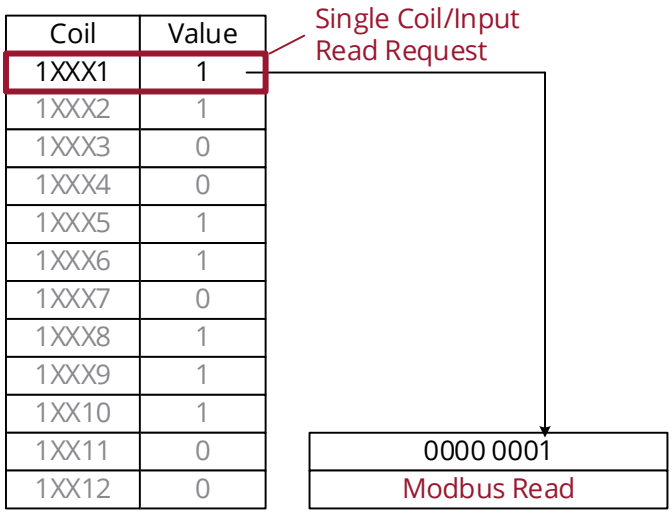
The PF2200 user interface communicates with the BMS card via a proprietary communication protocol called PFN. Modbus data is transferred from the BMS card to the user interface over the PFN link. When the user interface loses communication with the BMS card all Modbus registers return a value of 0 except for the Modbus Communication Error register and the Modbus Communication Error Counter register as indicated below:

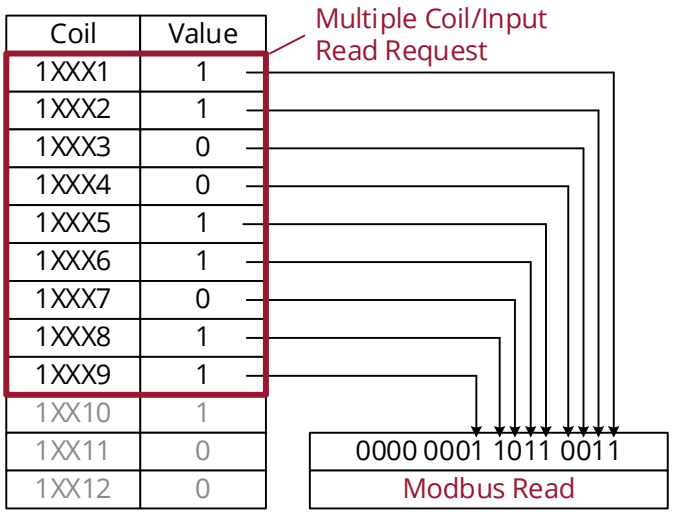
Address (Offset)		Read/Write	Name	Type	Read Value
30015/40015	(14)	Read Only	Modbus Communication Error	uint16	0 = No Error 1 = Communication Error
30016/40016	(15)	Read Only	Modbus Communication Error Counter * Increments every second while the BMS and UI are not communicating.	uint16	0 - 65535

2 MODBUS REGISTER MAP

2.1 READ ONLY COILS & DISCRETE INPUTS [FUNCTION CODE 0X01 OR 0X02]

Reading a single coil/input returns a single byte holding the requested coil/input value in its least significant bit and reading multiple coils/inputs returns a bit packed vector containing the requested coil/input values. Only requested values are returned (all other bits are set to 0) as indicated in the diagrams below:





Address (Offset)		Name	0	1
10101/20101 To 10356/20356	(100) To (355)	Alarm Bit AL000 To Alarm Bit AL255	Alarm not set	Alarm set
10501/20501 To 10564/20564	(500) To (563)	Wait Bit WT000 To Wait Bit WT063	Wait not set	Wait set
10601/20601 To 10664/20664	(600) To (663)	Warning Bit WN000 To Warning Bit WN063	Warning not set	Warning set
10701/20701 To 10764/20765	(700) To (764)	Main Permissive Bit MP000 To Main Permissive Bit MP063	Main Permissive not set	Main Permissive set
10801/20801	(800)	Proof of Closure A	Open	Closed
10802/20802	(801)	ESD	Open	Closed
10803/20803	(802)	Start	Open	Closed
10804/20804	(803)	Upstream Pressure	Open	Closed
10805/20805	(804)	Pressure A	Open	Closed
10806/20806	(805)	Pressure B	Open	Closed
10807/20807	(806)	Level/Flow	Open	Closed
10808/20808	(807)	Aux In 1	Open	Closed
10809/20809	(808)	Aux In 2	Open	Closed
10810/20810	(809)	Aux Temp	Open	Closed
10811/20811	(810)	Proof of Closure B	Open	Closed
10812/20812	(811)	Upstream Proof of Closure	Open	Closed

Address (Offset)		Name	0	1
10813/20813	(812)	Terminal 52	Open	Closed
10821/20821	(820)	Pilot A	De-energized	Energized
10822/20822	(821)	Pilot B	De-energized	Energized
10823/20823	(822)	SSV A	De-energized	Energized
10824/20824	(823)	SSV B	De-energized	Energized
10825/20825	(824)	Upstream SSV (SSV UP)	De-energized	Energized
10961/20961	(960)	Flame A Load Monitor Check Failure	Alarm not set	Alarm set
10962/20962	(961)	Flame B Load Monitor Check Failure	Alarm not set	Alarm set
10963/20963	(962)	Flame A Voltage Fault	Alarm not set	Alarm set
10964/20964	(963)	Flame B Voltage Fault	Alarm not set	Alarm set
10965/20965	(964)	Flame A DC Input Open Fault	Alarm not set	Alarm set
10966/20966	(965)	Flame B DC Input Open Fault	Alarm not set	Alarm set
10967/20967	(966)	Flame Detect Software Watchdog Trip	Alarm not set	Alarm set
11001/21001	(1000)	Switch Run Short	Alarm not set	Alarm set
11002/21002	(1001)	Switch Ignition Short	Alarm not set	Alarm set
11003/21003	(1002)	Start Short	Alarm not set	Alarm set
11004/21004	(1003)	Proof of Closure A Short	Alarm not set	Alarm set
11005/21005	(1004)	Terminal 52 Short	Alarm not set	Alarm set
11006/21006	(1005)	Proof of Closure B Short	Alarm not set	Alarm set
11007/21007	(1006)	ESD Short	Alarm not set	Alarm set
11021/21021	(1020)	Upstream Pressure Communication Bus Fault	Alarm not set	Alarm set
11022/21022	(1021)	Pressure A Communication Bus Fault	Alarm not set	Alarm set
11023/21023	(1022)	Pressure B Communication Bus Fault	Alarm not set	Alarm set
11024/21024	(1023)	Level/Flow Communication Bus Fault	Alarm not set	Alarm set
11025/21025	(1024)	Aux Temp Communication Bus Fault	Alarm not set	Alarm set
11026/21026	(1025)	Aux In 1 Communication Bus Fault	Alarm not set	Alarm set
11027/21027	(1026)	Aux In 2 Communication Bus Fault	Alarm not set	Alarm set
11028/21028	(1027)	Pilot A Communication Bus Fault	Alarm not set	Alarm set
11029/21029	(1028)	Pilot B Communication Bus Fault	Alarm not set	Alarm set
11030/21030	(1029)	SSV A Communication Bus Fault	Alarm not set	Alarm set
11031/21031	(1030)	SSV B Communication Bus Fault	Alarm not set	Alarm set
11032/21032	(1031)	Upstream SSV (SSV UP) Communication Bus Fault	Alarm not set	Alarm set
11033/21033	(1032)	System Voltage Communication Bus Fault	Alarm not set	Alarm set
11041/21041	(1040)	Pilot Start Internal Board Fault	Alarm not set	Alarm set
11042/21042	(1041)	Pilot Read Internal Board Fault	Alarm not set	Alarm set
11043/21043	(1042)	Pilot Stop Internal Board Fault	Alarm not set	Alarm set
11044/21044	(1043)	System Start Internal Board Fault	Alarm not set	Alarm set
11045/21045	(1044)	System Read Internal Board Fault	Alarm not set	Alarm set
11046/21046	(1045)	System Stop Internal Board Fault	Alarm not set	Alarm set
11047/21047	(1046)	Digital Input Start Internal Board Fault	Alarm not set	Alarm set
11048/21048	(1047)	Digital Input Read Internal Board Fault	Alarm not set	Alarm set
11049/21049	(1048)	Digital Input Stop Internal Board Fault	Alarm not set	Alarm set
11061/21061	(1060)	Aux Output Fault	Alarm not set	Alarm set
11062/21062	(1061)	TCV B Output Fault	Alarm not set	Alarm set
11063/21063	(1062)	TCV A Output Fault	Alarm not set	Alarm set

2.2 INPUT/HOLDING REGISTERS [READ: 0X03, 0X04 WRITE: 0X06, 0X10]

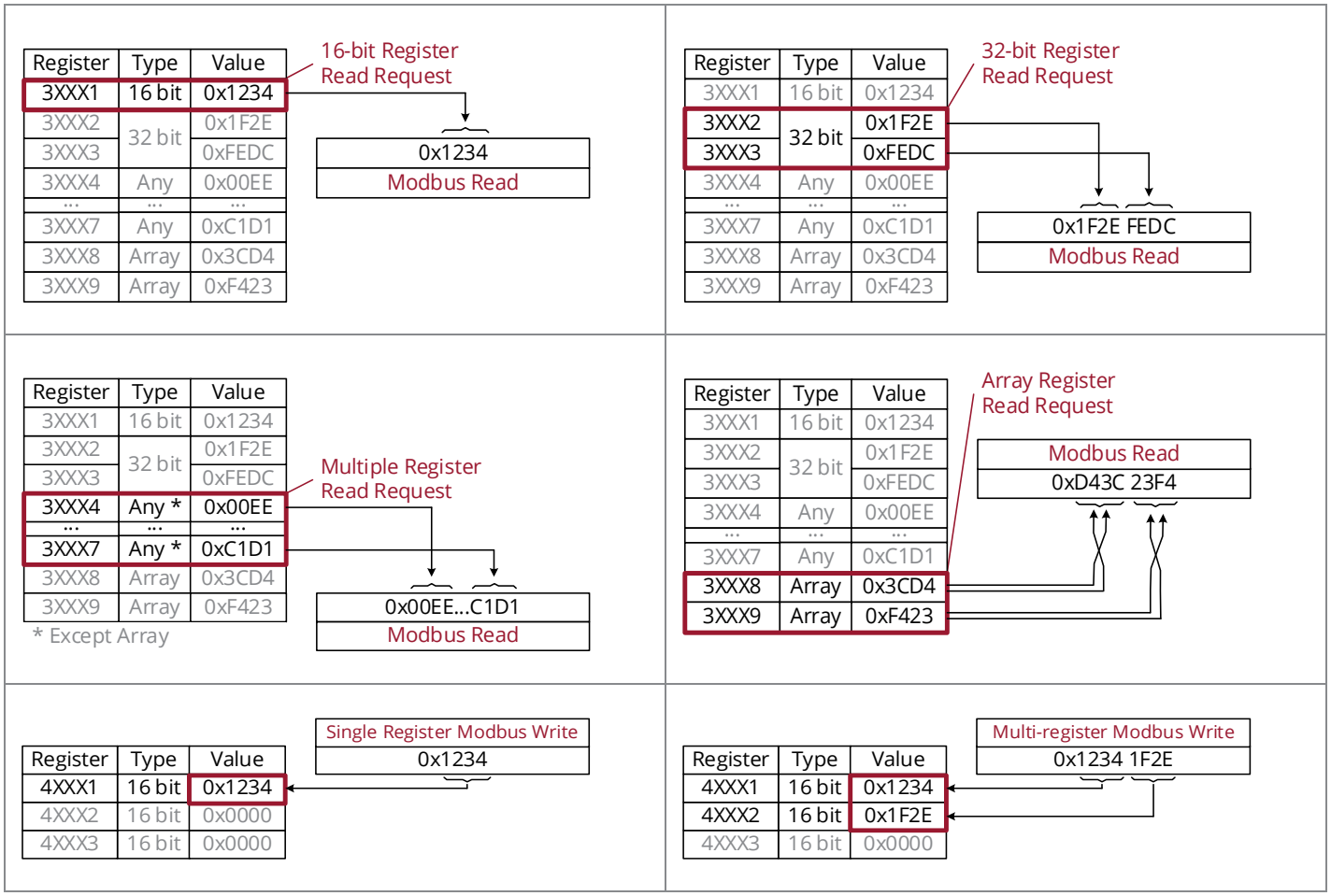
The Input Registers (300xx) are duplicated in the corresponding Holding Registers (400xx) for convenience and to maintain compatibility with some PLCs.

Use the Read Input Register command (0x04) to read the Input Registers (300xx).

Use the Read Holding Registers command (0x03) to read the Holding Registers (400xx).

Use the Preset Single Register command (0x06) or the Preset Multiple Registers command (0x10) to write the Holding Registers.

The following diagrams provide read and write examples for various register types.



2.2.1 TEST REGISTERS

The following registers can be used to test whether the Modbus Master is correctly configured and to confirm that both unsigned and signed values can be read properly.

Address (Offset)		Read/Write	Name	Type	Read Value		
					Decimal	Hexadecimal	Binary
30123/40123	(122)	Read Only	Test Read - Unsigned	uint16	1234	0x04D2	0b0000 0100 1101 0010
30124/40124	(123)	Read Only	Test Read - Signed	int16	-1234	0xFB2E	0b1111 1011 0010 1110

2.2.2 BMS SETTINGS AND FUNCTIONS

Address (Offset)		Read/ Write	Name	Type	10x	Range
30100/40100	(99)	R/W	Appliance Start/Stop	uint16		Read 0 = Command Accepted
						Write 1234 = Start both burners
						Write 4321 = Stop both burners
30110/40110	(109)	R/W	UI Clock Seconds	uint16		0 – 59 seconds
30111/40111	(110)	R/W	UI Clock Minutes	uint16		0 – 59 minutes
30112/40112	(111)	R/W	UI Clock Hour	uint16		0 – 23 hours
30113/40113	(112)	R/W	UI Clock Day	uint16		1 – 31 days
30114/40114	(113)	R/W	UI Clock Month	uint16		1 – 12 months
30115/40115	(114)	R/W	UI Clock Year	uint16		2000 – 2099 years
30121/40121	(120)	R/W	Modbus Remote Echo for Aux Out	uint16	10x	Sets Aux output when configured in Modbus Echo Mode
30143/40143	(142)	R/W	Clear Shutdown Code	uint16		0 = No effect
						1 = Acknowledge Lockout
30144/40144	(143)	Read Only	Burner A Shutdown Code	uint16		0 = No shutdown code set on Burner A
						Not 0 = Burner A shutdown code
30145/40145	(144)	Read Only	Burner B Shutdown Code	uint16		0 = No shutdown code set on Burner B
						Not 0 = Burner B shutdown code
30151/40151	(150)	R/W	Burner A Start/Stop	uint16		Read 0 = Command Accepted
						Write 1234 = Start Burner A
						Write 4321 = Stop Burner A
30152/40152	(151)	R/W	Burner B Start/Stop	uint16		Read 0 = Command Accepted
						Write 1234 = Start Burner B
						Write 4321 = Stop Burner B
31001/41001	(1000)	Read Only	Bath Type	uint16		0 = TC
						1 = RTD
31002/41002	(1001)	Read Only	Bath Mode	uint16		0 = Process Control
						1 = High Temp ESD
31003/41003	(1002)	Read Only	Bath Input	uint16		0 = Dual
						1 = Single
31004/41004	(1003)	Read Only	Bath High Temp Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
31005/41005	(1004)	R/W	Bath Pilot Off Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
* Write must be above the Bath Main Off Setpoint and more than 1 degree below the Bath High Temp Setpoint. Writing a value outside these bounds while running will cause a configuration error alarm and the system will shut down.						
31006/41006	(1005)	R/W	Bath Main Off Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
* Write must be more than 1 degree above the Bath Process Setpoint and below the Bath Pilot Off Setpoint. Writing a value outside these bounds while running will cause a configuration error alarm and the system will shut down.						
31007/41007	(1006)	R/W	Bath Process Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
* Write must be above the Bath Low Temp Setpoint and Standby Setpoint and must be at least 1 degree below the Bath Main Off Setpoint. Writing a value outside these bounds while running will cause a configuration error alarm and the system will shut down.						
31008/41008	(1007)	Read Only	Bath Low Temp Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
31009/41009	(1008)	R/W	Bath Deadband	uint16		0 - 100 °C (32 - 212 °F)
31010/41010	(1009)	Read Only	Outlet/Stack B Type	uint16		0 = TC
						1 = RTD
31011/41011	(1010)	Read Only	Outlet/Stack B Mode	uint16		0 = Disabled
						1 = Outlet Process Control
						2 = Outlet High Temp ESD
						3 = Outlet Display Only
						4 = Stack B High Temp ESD
						5 = Stack B Display Only
31012/41012	(1011)	Read Only	Outlet/Stack B High Temp Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
31013/41013	(1012)	R/W	Outlet Pilot Off Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
* Write must be above the Outlet Main Off Setpoint and more than 1 degree below the Outlet High Temp Setpoint. Writing a value outside these bounds while running will cause a configuration error alarm and the system will shut down.						
31014/41014	(1013)	R/W	Outlet Main Off Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
* Write must be more than 1 degree above the Outlet Process Setpoint and below the Outlet Pilot Off Setpoint. Writing a value outside these bounds while running will cause a configuration error alarm and the system will shut down.						
31015/41015	(1014)	R/W	Outlet Process Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
* Write must be above the Outlet Low Temp Setpoint and must be at least 1 degree below the Outlet Main Off Setpoint. Writing a value outside these bounds while running will cause a configuration error alarm and the system will shut down.						
31016/41016	(1015)	Read Only	Outlet Low Temp Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
31017/41017	(1016)	R/W	Outlet/Stack B Deadband	uint16		0 - 100 °C (32 - 212 °F)

Address (Offset)		Read/ Write	Name	Type	10x	Range
31018/41018	(1017)	Read Only	Stack Type	uint16		0 = TC
						1 = RTD
31019/41019	(1018)	Read Only	Stack Mode	uint16		0 = Disabled
						1 = High Temp ESD
						2 = Display Only
31020/41020	(1019)	Read Only	Stack High Temp Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
31021/41021	(1020)	R/W	Stack Deadband	uint16		0 - 100 °C (32 - 212 °F)
31022/41022	(1021)	Read Only	Aux Temp Mode	uint16		0 = Disabled
						1 = Process Control
						2 = High Temp ESD
						3 = Display Only
31023/41023	(1022)	Read Only	Aux Temp Type	uint16		0 = Invalid
						1 = Invalid
						2 = 4-20
31024/41024	(1023)	Read Only	Aux High Temp Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
31025/41025	(1024)	R/W	Aux Pilot Off Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
* Write must be above the Aux Temp Main Off Setpoint and more than 1 degree below the Aux Temp High Temp Setpoint. Writing a value outside these bounds while running will cause a configuration error alarm and the system will shut down.						
31026/41026	(1025)	R/W	Aux Main Off Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
* Write must be more than 1 degree above the Aux Temp Process Setpoint and below the Aux Temp Pilot Off Setpoint. Writing a value outside these bounds while running will cause a configuration error alarm and the system will shut down.						
31027/41027	(1026)	R/W	Aux Process Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
* Write must be above the Aux Temp Low Temp Setpoint and must be at least 1 degree below the Aux Temp Main Off Setpoint. Writing a value outside these bounds while running will cause a configuration error alarm and the system will shut down.						
31028/41028	(1027)	Read Only	Aux Low Temp Setpoint	int16		-40 - 1350 °C (-40 - 2462 °F)
31029/41029	(1028)	R/W	Aux Deadband	uint16		0 - 100 °C (32 - 212 °F)
31030/41030	(1029)	Read Only	Aux Temp Span Min	int16		-100 - 1350 °C (-148 - 2462 °F)
31031/41031	(1030)	Read Only	Aux Temp Span Max	int16		-100 - 1350 °C (-148 - 2462 °F)
31032/41032	(1031)	Read Only	Proof of Closure A (POC A)	uint16		0 = Disabled
						1 = Enabled
31033/41033	(1032)	Read Only	Remote Start	uint16		0 = Disabled
						1 = Enabled
31034/41034	(1033)	Read Only	Upstream Pressure Type	uint16		0 = Disabled
						1 = Digital
						2 = 4-20
31035/41035	(1034)	Read Only	Upstream Pressure Span Min	int32	10x	Reading multiplied by 10 in configured Pressure Units * Returns 0 if Pressure Units set to mA or %
31037/41037	(1036)	Read Only	Upstream Pressure Span Max	int32	10x	Reading multiplied by 10 in configured Pressure Units * Returns 0 if Pressure Units set to mA or %
31039/41039	(1038)	Read Only	Upstream Pressure Low Trip	int32	10x	Reading multiplied by 10 in configured Pressure Units
31041/41041	(1040)	Read Only	Upstream Pressure High Trip	int32	10x	Reading multiplied by 10 in configured Pressure Units
31043/41043	(1042)	Read Only	Upstream Pressure Deadband	uint16	10x	Reading multiplied by 10 in configured Pressure Units
31044/41044	(1043)	Read Only	Upstream Pressure Low Pressure Delay	uint16		2 - 20 seconds
31045/41045	(1044)	Read Only	Upstream Pressure Low Pressure Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
						3 = Main Permissive

Address (Offset)		Read/ Write	Name	Type	10x	Range
31048/41048	(1047)	Read Only	Level/Flow Type	uint16		0 = Disabled 1 = Digital 2 = 4-20
31049/41049	(1048)	Read Only	Level/Flow Digital Mode	uint16		0 = Alarm 1 = Wait 2 = Warning
31050/41050	(1049)	Read Only	Level/Flow Low Trip Mode	uint16		0 = Alarm 1 = Wait 2 = Warning
31051/41051	(1050)	Read Only	Level/Flow High Trip Mode	uint16		0 = Alarm 1 = Wait 2 = Warning
31052/41052	(1051)	Read Only	Level/Flow Span Min	int32	10x	Reading multiplied by 10 in configured Level/Flow Units * Returns 0 if Level/Flow Units set to mA or %
31054/41054	(1053)	Read Only	Level/Flow Span Max	int32	10x	Reading multiplied by 10 in configured Level/Flow Units * Returns 0 if Level/Flow Units set to mA or %
31056/41056	(1055)	Read Only	Level/Flow Low Trip	int32	10x	Reading multiplied by 10 in configured Level/Flow Units
31058/41058	(1057)	Read Only	Level/Flow High Trip	int32	10x	Reading multiplied by 10 in configured Level/Flow Units
31060/41060	(1059)	Read Only	Level/Flow Deadband	uint16	10x	Reading multiplied by 10 in configured Level/Flow Units
31061/41061	(1060)	Read Only	Level/Flow Delay	uint16		2 - 20 seconds
31065/41065	(1064)	Read Only	Aux In 1 Type	uint16		0 = Disabled 1 = Digital 2 = 4-20
31066/41066	(1065)	Read Only	Aux In 1 4-20 Mode	uint16		0 = High/Low Trip 1 = Burner A High/Low Trip 2 = Burner B High/Low Trip 3 = Appliance Firing Rate 4 = Bath Process SP Adjust 5 = Outlet Process SP Adjust 6 = Aux Temp Process SP Adjust
31067/41067	(1066)	Read Only	Aux In 1 Digital Mode	uint16		0 = Alarm 1 = Wait 2 = Warning 3 = Main Permissive
31068/41068	(1067)	Read Only	Aux In 1 Low Trip Mode	uint16		0 = Alarm 1 = Wait 2 = Warning 3 = Main Permissive
31069/41069	(1068)	Read Only	Aux In 1 High Trip Mode	uint16		0 = Alarm 1 = Wait 2 = Warning 3 = Main Permissive
31070/41070	(1069)	Read Only	Aux In 1 Low Trip	int32	10x	Reading multiplied by 10 in configured Aux In 1 Units
31072/41072	(1071)	Read Only	Aux In 1 High Trip	int32	10x	Reading multiplied by 10 in configured Aux In 1 Units
31074/41074	(1073)	Read Only	Aux In 1 Deadband	uint16	10x	Reading multiplied by 10 in configured Aux In 1 Units
31076/41076	(1075)	Read Only	Aux In 1 Span Min	int32	10x	Reading multiplied by 10 in configured Aux In 1 Units * Returns 0 if Aux In 1 Units set to mA or %
31078/41078	(1077)	Read Only	Aux In 1 Span Max	int32	10x	Reading multiplied by 10 in configured Aux In 1 Units * Returns 0 if Aux In 1 Units set to mA or %
31080/41080	(1079)	Read Only	Aux In 2 Type	uint16		0 = Disabled 1 = Digital 2 = 4-20
31081/41081	(1080)	Read Only	Aux In 2 4-20 Mode	uint16		0 = High/Low Trip 1 = Burner A High/Low Trip 2 = Burner B High/Low Trip 3 = Appliance Firing Rate 4 = Bath Process SP Adjust 5 = Outlet Process SP Adjust 6 = Aux Temp Process SP Adjust

Address (Offset)		Read/ Write	Name	Type	10x	Range
31082/41082	(1081)	Read Only	Aux In 2 Digital Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
						3 = Main Permissive
31083/41083	(1082)	Read Only	Aux In 2 Low Trip Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
						3 = Main Permissive
31084/41084	(1083)	Read Only	Aux In 2 High Trip Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
						3 = Main Permissive
31085/41085	(1084)	Read Only	Aux In 2 Low Trip	int32	10x	Reading multiplied by 10 in configured Aux In 2 Units
31087/41087	(1086)	Read Only	Aux In 2 High Trip	int32	10x	Reading multiplied by 10 in configured Aux In 2 Units
31089/41089	(1088)	Read Only	Aux In 2 Deadband	uint16	10x	Reading multiplied by 10 in configured Aux In 2 Units
31090/41090	(1089)	Read Only	Aux In 2 Span Min	int32	10x	Reading multiplied by 10 in configured Aux In 2 Units * Returns 0 if Aux In 2 Units set to mA or %
31092/41092	(1091)	Read Only	Aux In 2 Span Max	int32	10x	Reading multiplied by 10 in configured Aux In 2 Units * Returns 0 if Aux In 2 Units set to mA or %
31094/41094	(1093)	Read Only	Status Contact Mode	uint16		0 = Run Status
						1 = Heating Status
						2 = Low Temp Warning
						3 = Level/Flow Control
31095/41095	(1094)	Read Only	Aux Out 1 Mode	uint16		0 = Disabled
						1 = Level/Flow Echo
						2 = N/A
						3 = Aux In 1 Echo
						4 = Aux In 2 Echo
						5 = N/A
						6 = N/A
						7 = N/A
						8 = Modbus Echo
						9 = Bath Temp Echo
						10 = Outlet Temp Echo
						11 = Stack Temp Echo
						12 = Aux Temp Echo
31097/41097	(1096)	Read Only	Aux Out Temp Echo Span Min	int16		-100 - 1350 °C (-148 - 2462 °F)
31098/41098	(1097)	Read Only	Aux Out Temp Echo Span Max	int16		-100 - 1350 °C (-148 - 2462 °F)
31101/41101	(1100)	Read Only	Pilot Valve A PWM	uint16		10 - 100 %
31102/41102	(1101)	Read Only	SSV A PWM	uint16		10 - 100 %
31103/41103	(1102)	Read Only	Upstream SSV (SSV UP) PWM	uint16		10 - 100 %
31104/41104	(1103)	Read Only	TCV Min Position	uint16		0 - 70 %
31105/41105	(1104)	Read Only	TCV Purge Position	uint16		0 - 100 %
31106/41106	(1105)	Read Only	TCV Pilot Position	uint16		0 - 100 %
31107/41107	(1106)	Read Only	TCV Manual Override	uint16		0 = Disabled
						1 = Enabled
31108/41108	(1107)	Read Only	TCV Manual Position	uint16		0 - 100 %
31109/41109	(1108)	R/W	Process Proportional Band	uint16	10x	°C Range: 0 - 10000 (0 - 1000°C)
						°F Range: 320 - 18320 (32 - 1832°F)
31110/41110	(1109)	R/W	Process Integral Time	uint16	10x	0 - 10000 (0 - 1000 min/rep)
31111/41111	(1110)	R/W	Process Derivative Time	uint16	10x	0 - 10000 (0 - 1000 min)
31112/41112	(1111)	R/W	Process Integral Reset Range	uint16	10x	°C Range: 0 - 10000 (0 - 1000°C)
						°F Range: 320 - 18320 (32 - 1832°F)

Address (Offset)		Read/ Write	Name	Type	10x	Range
31113/41113	(1112)	R/W	Cascade SP Proportional Band	uint16	10x	°C Range: 0 - 10000 (0 - 1000°C)
						°F Range: 320 - 18320 (32 - 1832°F)
31114/41114	(1113)	R/W	Cascade SP Integral Time	uint16	10x	0 - 10000 (0 - 1000 mins/rep)
31115/41115	(1114)	R/W	Cascade SP Derivative Time	uint16	10x	0 - 10000 (0 - 1000 min)
31116/41116	(1115)	R/W	Cascade SP Integral Reset Range	uint16	10x	°C Range: 0 - 10000 (0 - 1000°C)
						°F Range: 320 - 18320 (32 - 1832°F)
31117/41117	(1116)	R/W	PID Output Rate Limit	uint16	10x	1 - 1000 (0.1 = 100 %/sec)
31118/41118	(1117)	R/W	PID Ramp Time	uint16		0 - 255 seconds
31119/41119	(1118)	Read Only	Process Control Mode	uint16		0 = On/Off Control
						1 = Bath PID Control
						2 = Outlet PID Control
						3 = Aux PID Control
						4 = Cascaded PID Control
						5 = External Firing Rate
31120/41120	(1119)	Read Only	Pilot Off Mode	uint16		0 = Disabled
						1 = Off At Pilot Off Setpoint
						2 = Off At Main Off Setpoint
31121/41121	(1120)	Read Only	Minimum Burners Running	uint16		1 - 2
31122/41122	(1121)	Read Only	Relight Attempts	uint16		0 - 3
31123/41123	(1122)	Read Only	Ignition Mode	uint16		0 = Coil
						1 = HEI
31124/41124	(1123)	Read Only	Purge Time	uint16		10 - 900 seconds
31125/41125	(1124)	Read Only	Pilot Startup Delay Time	uint16		5 - 600 seconds
31126/41126	(1125)	Read Only	Main Startup Delay Time	uint16		30 - 600 seconds
31127/41127	(1126)	Read Only	Voltage Setting	uint16		0 = 12V
						1 = 24V
31128/41128	(1127)	Read Only	Voltage Restart	uint16		0 = Disabled
						1 = Enabled
31129/41129	(1128)	Read Only	L1 Password Enable	uint16		0 = Disabled
						1 = Enabled
31130/41130	(1129)	Read Only	Commissioning Complete	uint16		0 = Incomplete
						1 = Complete
31131/41131	(1130)	Read Only	Slave Address	uint16		1 - 247
31132/41132	(1131)	Read Only	Baud Rate	uint16		0 = 9600
						1 = 19200
31133/41133	(1132)	Read Only	Stop Bits	uint16		0 = 1
						1 = 2
31134/41134	(1133)	Read Only	Parity	uint16		0 = None
						1 = Odd
						2 = Even
31135/41135	(1134)	Read Only	Modbus Termination	uint16		0 = Disabled
						1 = Enabled
31136/41136	(1135)	Read Only	Remote Access	uint16		0 = Disabled
						1 = Enabled

Address (Offset)		Read/ Write	Name	Type	10x	Range
31137/41137	(1136)	Read Only	Temperature Units	uint16		0 = Celsius
						1 = Fahrenheit
31138/41138	(1137)	Read Only	Pressure Units	uint16		0 = kPa
						1 = psi
						2 = inch wc
						3 = oz/in2
						4 = kg/cm2
						5 = Percent
						6 = Milliamps
31139/41139	(1138)	Read Only	Level Units	uint16		0 = Litres
						1 = m3
						2 = US Gallons
						3 = bbl
						4 = ft3
						5 = Percent
						6 = Milliamps
31140/41140	(1139)	Read Only	Aux In 1 Units	uint16		0 = Percent
						1 = Milliamps
						2 = Temperature
						3 = Pressure
						4 = Level
						5 = Flow
						6 = Percent O2
31141/41141	(1140)	Read Only	Aux In 2 Units	uint16		0 = Percent
						1 = Milliamps
						2 = Temperature
						3 = Pressure
						4 = Level
						5 = Flow
						6 = Percent O2
31144/41144	(1143)	Read Only	Level/Flow Control Setpoint	int32	10x	Reading multiplied by 10 in configured Level/Flow units
31201/41201	(1200)	Read Only	Request Light Off Delay Time	uint16		30 – 600 seconds
31228/41228	(1227)	Read Only	Bath Standby Mode	uint16		0 = Disabled
						1 = Enabled
31229/41229	(1228)	Read Only	Bath Standby Cool Off Mode	uint16		0 = Waiting
						1 = Pilot
31230/41230	(1229)	R/W	Bath Standby Setpoint	uint16		-40 - 1350 °C (-40 - 2462 °F)
* Write must be below the Bath Process Setpoint. Writing a value below will cause a configuration error alarm and the system will shut down.						
31301/41301	(1300)	Read Only	Flow Units	uint16		0 = L/sec
						1 = L/min
						2 = m3/sec
						3 = m3/min
						4 = US Gal/sec
						5 = US Gal/min
						6 = bbl/sec
						7 = bbl/min
						8 = ft3/sec
						9 = ft3/min
						10 = Percent
						11 = Milliamps
31302/41302	(1301)	Read Only	Level/Flow Input Units	uint16		0 = Level
						1 = Flow

Address (Offset)		Read/ Write	Name	Type	10x	Range
32031/42031	(2030)	Read Only	Upstream Pressure Digital Type	uint16		0 = Low
						1 = High
32032/42032	(2031)	Read Only	Proof of Closure B (POC B)	uint16		0 = Disabled
						1 = Enabled
32033/42033	(2032)	Read Only	Upstream Proof of Closure (POC Up)	uint16		0 = Disabled
						1 = Enabled
32034/42034	(2033)	Read Only	Pressure A Type	uint16		0 = Disabled
						1 = Digital
						2 = 4-20
32035/42035	(2034)	Read Only	Pressure A Span Min	int32	10x	Reading multiplied by 10 in configured Pressure Units * Returns 0 if Pressure Units set to mA or %
32037/42037	(2036)	Read Only	Pressure A Span Max	int32	10x	Reading multiplied by 10 in configured Pressure Units * Returns 0 if Pressure Units set to mA or %
32039/42039	(2038)	Read Only	Pressure A Low Trip	int32	10x	Reading multiplied by 10 in configured Pressure Units
32041/42041	(2040)	Read Only	Pressure A High Trip	int32	10x	Reading multiplied by 10 in configured Pressure Units
32043/42043	(2042)	Read Only	Pressure A Deadband	uint16	10x	Reading multiplied by 10 in configured Pressure Units
32044/42044	(2043)	Read Only	Pressure A Low Pressure Delay	uint16		2 - 20 seconds
32045/42045	(2044)	Read Only	Pressure A Low Pressure Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
						3 = Main Permissive
32054/42054	(2053)	Read Only	Pressure B Type	uint16		0 = Disabled
						1 = Digital
						2 = 4-20
32055/42055	(2054)	Read Only	Pressure B Span Min	int32	10x	Reading multiplied by 10 in configured Pressure Units * Returns 0 if Pressure Units set to mA or %
32057/42057	(2056)	Read Only	Pressure B Span Max	int32	10x	Reading multiplied by 10 in configured Pressure Units * Returns 0 if Pressure Units set to mA or %
32059/42059	(2058)	Read Only	Pressure B Low Trip	int32	10x	Reading multiplied by 10 in configured Pressure Units
32061/42061	(2060)	Read Only	Pressure B High Trip	int32	10x	Reading multiplied by 10 in configured Pressure Units
32063/42063	(2062)	Read Only	Pressure B Deadband	uint16	10x	Reading multiplied by 10 in configured Pressure Units
32064/42064	(2063)	Read Only	Pressure B Low Pressure Delay	uint16		2 - 20 seconds
32065/42065	(2064)	Read Only	Pressure B Low Pressure Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
						3 = Main Permissive
32101/42101	(2100)	Read Only	Pilot Valve B PWM	uint16		10 - 100 %
32102/42102	(2101)	Read Only	SSV B PWM	uint16		10 - 100 %
32103/42103	(2102)	Read Only	Shared TCV	uint16		0 = Disabled
						1 = Enabled
32121/42121	(2120)	Read Only	Valve Sync	uint16		0 = Disabled
						1 = Enabled

2.2.3 BMS READ ONLY STATUS INFORMATION

Address (Offset)		Name	Type	10x	Range	
33001/43001 33002/43002	(3000) (3001)	Controller A State Controller B State	int16		-1 = Invalid	
					0 = Lockout	
					1 = Alarm	
					2 = Power On	
					3 = Ready	
					4 = Waiting – Confirm start	
					5 = Waiting	
					6 = Ignition – Pre-ignition	
					7 = Ignition	
					8 = Pilot – Pilot startup delay	
					9 = Pilot	
					10 = Main Light Off - Request light off	
					11 = Main Light Off – Main Delay	
					12 = Main	
					13 = PID Control	
33003/43003	(3002)	Burner A Shutdown Code	uint16		0 - 255	
33004/43004	(3003)	Burner B Shutdown Code	uint16		0 - 255	
33005/43005	(3004)	Burner A Relights Remaining	uint16		0 - 3	
33006/43006	(3005)	Burner A State Timer	uint16		Current state timer in seconds.	
33007/43007	(3006)	Burner A Purge Timer	uint16		Purge timer in seconds.	
33008/43008	(3007)	Delta Time	uint16		Processors delta time in milliseconds.	
33010/43010	(3009)	Pilot A Flame Establishment Failures	uint16		Pilot A flame establishment failures since last power on	
33012/43012	(3011)	Pilot B Flame Establishment Failures	uint16		Pilot B flame establishment failures since last power on	
33104/43104	(3103)	Alarm Bits 192 to 207	Bitset		0b**0**000 0000 0000 0000: AL207 0b0000 0000 0000 000**0:** AL192	0 = Alarm not set 1 = Alarm set
33105/43105	(3104)	Alarm Bits 176 to 191	Bitset		0b**0**000 0000 0000 0000: AL191 0b0000 0000 0000 000**0:** AL176	
33106/43106	(3105)	Alarm Bits 160 to 175	Bitset		0b**0**000 0000 0000 0000: AL175 0b0000 0000 0000 000**0:** AL160	
33107/43107	(3106)	Alarm Bits 144 to 159	Bitset		0b**0**000 0000 0000 0000: AL159 0b0000 0000 0000 000**0:** AL144	
33108/43108	(3107)	Alarm Bits 128 to 143	Bitset		0b**0**000 0000 0000 0000: AL143 0b0000 0000 0000 000**0:** AL128	
33109/43109	(3108)	Alarm Bits 112 to 127	Bitset		0b**0**000 0000 0000 0000: AL127 0b0000 0000 0000 000**0:** AL112	
33110/43110	(3109)	Alarm Bits 96 to 111	Bitset		0b**0**000 0000 0000 0000: AL111 0b0000 0000 0000 000**0:** AL096	
33111/43111	(3110)	Alarm Bits 80 to 95	Bitset		0b**0**000 0000 0000 0000: AL095 0b0000 0000 0000 000**0:** AL080	
33112/43112	(3111)	Alarm Bits 64 to 79	Bitset		0b**0**000 0000 0000 0000: AL079 0b0000 0000 0000 000**0:** AL064	
33113/43113	(3112)	Alarm Bits 48 to 63	Bitset		0b**0**000 0000 0000 0000: AL063 0b0000 0000 0000 000**0:** AL048	
33114/43114	(3113)	Alarm Bits 32 to 47	Bitset		0b**0**000 0000 0000 0000: AL047 0b0000 0000 0000 000**0:** AL032	
33115/43115	(3114)	Alarm Bits 16 to 31	Bitset		0b**0**000 0000 0000 0000: AL031 0b0000 0000 0000 000**0:** AL016	
33116/43116	(3115)	Alarm Bits 0 to 15	Bitset		0b**0**000 0000 0000 0000: AL015 0b0000 0000 0000 000**0:** AL000	

Address (Offset)		Name	Type	10x	Range	
33202/43202	(3201)	Wait Bits 32 to 47	Bitset		0b**0**000 0000 0000 0000: WT047 0b0000 0000 0000 000**0**: WT032	0 = Wait not set 1 = Wait set
33203/43203	(3202)	Wait Bits 16 to 31	Bitset		0b**0**000 0000 0000 0000: WT031 0b0000 0000 0000 000**0**: WT016	
33204/43204	(3203)	Wait Bits 0 to 15	Bitset		0b**0**000 0000 0000 0000: WT015 0b0000 0000 0000 000**0**: WT000	
33301/43301	(3300)	Warning Bits 48 to 63	Bitset		0b**0**000 0000 0000 0000: WN063 0b0000 0000 0000 000**0**: WN048	0 = Warning not set 1 = Warning set
33302/43302	(3301)	Warning Bits 32 to 47	Bitset		0b**0**000 0000 0000 0000: WN047 0b0000 0000 0000 000**0**: WN032	
33303/43303	(3302)	Warning Bits 16 to 31	Bitset		0b**0**000 0000 0000 0000: WN031 0b0000 0000 0000 000**0**: WN016	
33304/43304	(3303)	Warning Bits 0 to 15	Bitset		0b**0**000 0000 0000 0000: WN015 0b0000 0000 0000 000**0**: WN000	
33403/43403	(3402)	Main Permissive Bits 16 to 31	Bitset		0b**0**000 0000 0000 0000: MP031 0b0000 0000 0000 000**0**: MP016	0 = Main Permissive not set 1 = Main Permissive set
33404/43404	(3403)	Main Permissive Bits 0 to 15	Bitset		0b**0**000 0000 0000 0000: MP015 0b0000 0000 0000 000**0**: MP000	
33501/43501	(3500)	System Voltage	int16	10x	System Voltage reading multiplied by 10	
33502/43502	(3501)	Authentication Level	uint16		0 = None	
					1 = Remote	
					2 = L1	
					3 = L2	
					4 = SYS	
33503/43503	(3502)	Appliance Running	uint16		0 = No burners in a running state	
					1 = Any burner in a running state	
33504/43504	(3503)	Sync Count	uint32		Processor synchronization count	
33507/43507	(3506)	Hardware Model Number	uint32		Expected reading: 0x220002	
33509/43509	(3508)	Firmware Product Variant	uint16		0 = Invalid	
					2 = Dual Burner	
33510/43510	(3509)	Region Code	uint16		0 = Invalid	
					1 = North America	
33511/43511	(3510)	Bundle Version	uint32		0x**0A**0B0C0D: Product Variant	Example: A read of 0x02020003 corresponds to a firmware bundle of DB 2.0.3
					0x0A**0B**0C0D: Major version	
					0x0A0B**0C**0D: Minor version	
					0x0A0B0C**0D**: Release Number	
33513/43513	(3512)	Firmware Version	uint32		0x**0A**0B0C0D: Major version	
					0x0A**0B**0C0D: Minor version	
					0x0A0B**0C**0D: Release number high byte	
					0x0A0B0C**0D**: Release number low byte	
33515/43515	(3514)	Bootloader Version	uint32		0x**0A**0B0C0D: Major version	
					0x0A**0B**0C0D: Minor version	
					0x0A0B**0C**0D: Release number high byte	
					0x0A0B0C**0D**: Release number low byte	
33517/43517	(3516)	BOM Version	uint32		0x**0A**0B0C0D: Major version	
					0x0A**0B**0C0D: Minor version	
					0x0A0B**0C**0D: Release number high byte	
					0x0A0B0C**0D**: Release number low byte	
33519/43519	(3518)	BMS Serial Number Byte 0 and 1	Array		e.g., S/N: 0A0B 0C0D **0E0F** Register read: 0x**0F0E** * Note that the byte order is reversed between the serial number and the register read.	
33520/43520	(3519)	BMS Serial Number Byte 2 and 3	Array		e.g., S/N: 0A0B **0C0D** 0E0F Register read: 0x**0D0C** * Note that the byte order is reversed between the serial number and the register read.	
33521/43521	(3520)	BMS Serial Number Byte 4 and 5	Array		e.g., S/N: **0A0B** 0C0D 0E0F Register read: 0x**0B0A** * Note that the byte order is reversed between the serial number and the register read.	

Address (Offset)		Name	Type	10x	Range	
33522/43522	(3521)	Manufacture Date	uint32		0x**0A**0B0C0D: N/A	
					0x0A**0B**0C0D: Year – 2000	
					0x0A0B**0C**0D: Month	
					0x0A0B0C**0D**: Day	
33524/43524	(3523)	Manufacture Test Date	uint32		0x**0A**0B0C0D: N/A	
					0x0A**0B**0C0D: Year – 2000	
					0x0A0B**0C**0D: Month	
					0x0A0B0C**0D**: Day	
33526/43526	(3525)	PFN Version	uint32		0x**0A**0B0C0D: Major	
					0x0A**0B**0C0D: Minor	
					0x0A0B**0C**0D: Release number high byte	
					0x0A0B0C**0D**: Release number low byte	
33605/43605	(3604)	Bath Temp	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)	
					°F Range: -1480 - 24620 (-148 - 2462°F)	
33606/43606	(3605)	Bath 2 Temp	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)	
					°F Range: -1480 - 24620 (-148 - 2462°F)	
33607/43607	(3606)	Outlet Temp	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)	
					°F Range: -1480 - 24620 (-148 - 2462°F)	
33608/43608	(3607)	Stack Temp	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)	
					°F Range: -1480 - 24620 (-148 - 2462°F)	
33609/43609	(3608)	Aux Temp	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)	
					°F Range: -1480 - 24620 (-148 - 2462°F)	
33610/43610	(3609)	Ambient Temp 1	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)	
					°F Range: -1480 - 24620 (-148 - 2462°F)	
33611/43611	(3610)	Ambient Temp 2	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)	
					°F Range: -1480 - 24620 (-148 - 2462°F)	
33672/43672	(3671)	Pilot A Flame Status	uint16		0 = No Flame	
					1 = Flame	
33673/43673	(3672)	Pilot B Flame Status	uint16		0 = No Flame	
					1 = Flame	
33675/43675	(3674)	Pilot Faults	Bitset		0b0000 000**0**: Flame A Load Monitor Check Failure	0 = Alarm not set 1 = Alarm set
					0b0000 00**0**0: Flame B Load Monitor Check Failure	
					0b0000 0**0**00: Flame A Voltage Fault	
					0b0000 **0**000: Flame B Voltage Fault	
					0b000**0** 0000: Flame A DC Input Open Fault	
					0b00**0**0 0000: Flame B DC Input Open Fault	
					0b0**0**00 0000: Flame Detect Software Watchdog Trip	
33685/43685	(3684)	Interlock Input Contact Status	Bitset		0b0000 0000 0000 000**0**: Proof of Closure A	0 = De-energized 1 = Energized
					0b0000 0000 0000 00**0**0: ESD	
					0b0000 0000 0000 0**0**00: Start	
					0b0000 0000 0000 **0**000: Upstream Pressure	
					0b0000 0000 000**0** 0000: Pressure A	
					0b0000 0000 00**0**0 0000: Pressure B	
					0b0000 0000 0**0**00 0000: Level/Flow	
					0b0000 0000 **0**000 0000: Aux In 1	
					0b0000 000**0** 0000 0000: Aux In 2	
					0b0000 00**0**0 0000 0000: Aux Temp	
					0b0000 0**0**00 0000 0000: Proof of Closure B	
					0b0000 **0**000 0000 0000: Upstream Proof of Closure	
					0b000**0** 0000 0000 0000: Terminal 52	

Address (Offset)		Name	Type	10x	Range	
33690/43690	(3689)	IO Short Faults	Bitset		0b0000 0000: Switch Run	0 = Alarm not set 1 = Alarm set
					0b0000 0000: Switch Ignition	
					0b0000 0000: Start	
					0b0000 0000: Proof of Closure A	
					0b0000 0000: Terminal 52	
					0b0000 0000: Proof of Closure B	
					0b0000 0000: ESD	
33695/43695	(3694)	POC B Voltage	int16		POC B Input Voltage divided by 10	
33696/43696	(3695)	POC UP Voltage	int16		POC UP Input Voltage divided by 10	
33698/43698	(3697)	ESD Voltage	int16		ESD Input Voltage divided by 10	
33699/43699	(3698)	Start Voltage	int16		Start Input Voltage divided by 10	
33700/43700	(3699)	POC A Voltage	int16		POC A Input Voltage divided by 10	
33701/43701	(3700)	4-20 Level/Flow	int32	10x	4-20 Level/Flow input reading multiplied by 10	
33703/43703	(3702)	4-20 Upstream Pressure	int32	10x	4-20 Upstream Pressure input reading multiplied by 10	
33705/43705	(3704)	4-20 Pressure A	int32	10x	4-20 Pressure A input reading multiplied by 10	
33708/43708	(3707)	4-20 Aux Temp	int16	10x	4-20 Aux Temp input reading multiplied by 10	
33709/43709	(3708)	4-20 Aux In 1	int32	10x	4-20 Aux In 1 input reading multiplied by 10	
33711/43711	(3710)	4-20 Aux In 2	int32	10x	4-20 Aux In 2 input reading multiplied by 10	
33713/43713	(3712)	Process SP Adjust Target Temp	int16	10x	Process SP Adjust target temperature setpoint multiplied by 10	
33714/43714	(3713)	External Switch State	uint16		0 = Stop	
					1 = Run	
					2 = Ignite	
					3 = Invalid	
					4 = Stuck	
33715/43715	(3714)	I2C Bus Faults	Bitset		0b0000 0000 0000 0000: Upstream Pressure	0 = Alarm not set 1 = Alarm set
					0b0000 0000 0000 0000: Pressure A	
					0b0000 0000 0000 0000: Pressure B	
					0b0000 0000 0000 0000: Level/Flow	
					0b0000 0000 0000 0000: Aux Temp	
					0b0000 0000 0000 0000: Aux In 1	
					0b0000 0000 0000 0000: Aux In 2	
					0b0000 0000 0000 0000: Pilot A	
					0b0000 0000 0000 0000: Pilot B	
					0b0000 0000 0000 0000: SSV A	
					0b0000 0000 0000 0000: SSV B	
					0b0000 0000 0000 0000: SSV UP	
					0b0000 0000 0000 0000: System Current	
33720/43720	(3719)	ADC Faults	Bitset		0b0000 0000 0000 0000: Pilot Start	0 = Alarm not set 1 = Alarm set
					0b0000 0000 0000 0000: Pilot Read	
					0b0000 0000 0000 0000: Pilot Stop	
					0b0000 0000 0000 0000: System Start	
					0b0000 0000 0000 0000: System Read	
					0b0000 0000 0000 0000: System Stop	
					0b0000 0000 0000 0000: Digital Input Start	
					0b0000 0000 0000 0000: Digital Input Read	
					0b0000 0000 0000 0000: Digital Input Stop	
33725/43725	(3724)	Valve Driver Status	Bitset		0b0000 0000: Pilot A	0 = De-energized 1 = Energized
					0b0000 0000: Pilot B	
					0b0000 0000: SSV A	
					0b0000 0000: SSV B	
					0b0000 0000: SSV UP	
33730/43730	(3729)	Status Contact State	uint16		0 = Deenergized	
					1 = Energized	
33732/43732	(3731)	Aux Output Fault	uint16		0 = Absent	
					1 = Present	
33733/43733	(3732)	TCV B Output Fault	uint16		0 = Absent	
					1 = Present	

Address (Offset)		Name	Type	10x	Range	
33734/43734	(3733)	TCV A Output Fault	uint16		0 = Absent	
					1 = Present	
33737/43737	(3736)	TCV A Output Percent	uint16		0 - 100%	
33738/43738	(3737)	Firing Rate	uint16		0 - 100%	
33739/43739	(3738)	Reserved				
33740/43740	(3739)	Cascade PID Setpoint	int16	10x	Cascaded PID setpoint in configured Temperature units multiplied by 10	
33742/43742	(3741)	Pilot A Voltage	int16	10x	Pilot A Voltage multiplied by 10	
33743/43743	(3742)	Pilot A Current	int16	10x	Pilot A Current multiplied by 10	
33744/43744	(3743)	Pilot B Voltage	int16	10x	Pilot B Voltage multiplied by 10	
33745/43745	(3744)	Pilot B Current	int16	10x	Pilot B Current multiplied by 10	
33746/43746	(3745)	SSV A Voltage	int16	10x	SSV A Voltage multiplied by 10	
33747/43747	(3746)	SSV A Current	int16	10x	SSV A Current multiplied by 10	
33748/43748	(3747)	SSV B Voltage	int16	10x	SSV B Voltage multiplied by 10	
33749/43749	(3748)	SSV B Current	int16	10x	SSV B Current multiplied by 10	
33750/43750	(3749)	Upstream SSV (SSV UP) Voltage	int16	10x	SSV UP Voltage multiplied by 10	
33751/43751	(3750)	Upsteam SSV (SSV UP) Current	int16	10x	SSV UP Current multiplied by 10	
33752/43752	(3751)	System Current	int16	10x	System Current multiplied by 10	
33753/43753	(3752)	System Power	int16	10x	System Power multiplied by 10	
33754/43754	(3753)	Pilot A Flame DC High Voltage	int16		Pilot A Flame DC High Voltage in millivolts	
33755/43755	(3754)	Pilot A Flame DC Low Voltage	int16		Pilot A Flame DC Low Voltage in millivolts	
33756/43756	(3755)	Pilot A AC Voltage	int16		Pilot A AC Voltage in millivolts	
33757/43757	(3756)	Pilot B Flame DC High Voltage	int16		Pilot B Flame DC High Voltage in millivolts	
33758/43758	(3757)	Pilot B Flame DC Low Voltage	int16		Pilot B Flame DC Low Voltage in millivolts	
33759/43759	(3758)	Pilot B AC Voltage	int16		Pilot B AC Voltage in millivolts	
33760/43760	(3759)	Valve Power Status	Bitset		0b0000 000**0**: Pilot A	0 = De-energized 1 = Energized
					0b0000 00**0**0: Pilot B	
					0b0000 0**0**00: SSV A	
					0b0000 **0**000: SSV B	
					0b000**0** 0000: SSV UP	
33765/43765	(3764)	System Up Time	uint16		System Up Time since last power on in hours	
33766/43766	(3765)	Average Hourly Energy Consumption	uint16	10x	Average Hourly Energy Consumption multiplied by 10 in Watts/hour	
33767/43767	(3766)	Pilot A Solenoid Run Time	uint16		Pilot A Solenoid Run Time since last power on in hours	
33768/43768	(3767)	SSV A Run Time	uint16		SSV A Run Time since last power on in hours	
33769/43769	(3768)	Upstream SSV (SSV UP) Run Time	uint16		SSV UP Run Time since last power on in hours	
33770/43770	(3769)	Burner A Average Firing Rate	uint16		Average Firing Rate since last power on in %	
33771/43771	(3770)	Pilot A Flame Fail Count	uint16		Pilot A Flame Fail Count since last power on	
33772/43772	(3771)	Pilot B Flame Fail Count	uint16		Pilot B Flame Fail Count since last power on	
33773/43773	(3772)	Pilot A Flame Strength	int16		Pilot A Flame Strength in millivolts	
33774/43774	(3773)	Pilot B Flame Strength	int16		Pilot B Flame Strength in millivolts	
33775/43775	(3774)	Pilot B Solenoid Run Time	uint16		Pilot B Solenoid Run Time since last power on in hours	
33776/43776	(3775)	SSV B Solenoid Run Time	uint16		SSV B Solenoid Run Time since last power on in hours	
33777/43777	(3776)	Burner B Average Firing Rate	uint16		Average Firing Rate since last power on in %	
33778/43778	(3777)	4-20 Pressure B	int32	10x	4-20 Pressure B input reading multiplied by 10	
33780/43780	(3779)	Hardware Product Variant	uint16		0 = Invalid	
					2 = Dual Burner	
33786/43786	(3785)	Aux Out Percent	uint16		0 – 100%	
33791/43791	(3790)	Reserved				
34005/44005	(4004)	Burner B Relights Remaining	uint16		0 - 3	
34006/44006	(4005)	Burner B State Timer	uint16		Current state timer in seconds.	
34007/44007	(4006)	Burner B Purge Timer	uint16		Purge timer in seconds.	
34011/44011	(4010)	Burner A Running	uint16		0 = Burner not in a running state	
					1 = Burner in a running state	
34012/44012	(4011)	Burner B Running	uint16		0 = Burner not in a running state	
					1 = Burner in a running state	
34021/44021	(4020)	TCV B Output Percent	uint16		0 - 100%	
34022/44022	(4021)	System Voltage Mismatch Fault	uint16		0 = Absent	
					1 = Present	

2.3 PF2100 LEGACY REGISTERS

Select PF2100 Modbus registers are available on the PF2200-DB to support minimum functionality for direct replacement of PF2100 systems installed in dual burner applications. It is recommended that these registers remain unused when possible.

Address (Offset)		Read/Write	Name	Type	10x	Range
10001/20001	(0)	Read Only	Run	Coil		0 = Both burners are stopped
						1 = Either burner is in a running state
10003/20003	(2)	Read Only	Pilot A	Coil		0 = Pilot A output is de-energized
						1 = Pilot A output is energized
10004/20004	(3)	Read Only	SSV A	Coil		0 = SSV A output is de-energized
						1 = SSV A output is energized
10005/20005	(4)	Read Only	Pilot B	Coil		0 = Pilot B output is de-energized
						1 = Pilot B output is energized
10006/20006	(5)	Read Only	SSV B	Coil		0 = SSV B output is de-energized
						1 = SSV B output is energized
10007/20007	(6)	Read Only	Upstream SSV	Coil		0 = SSV Up output is de-energized
						1 = SSV Up output is energized
10017/20017	(16)	Read Only	Low Level/Flow Input	Coil		0 = Level/Flow digital input is closed or 4-20mA input reading is at or above its Low Trip setting
						1 = Level/Flow digital input is open or 4-20mA input reading is below its Low Trip setting
10020/20020	(19)	Read Only	High Pressure Input	Coil		0 = Pressure A, Pressure B and Upstream Pressure 4-20mA input readings are all at or below their High Trip settings
						1 = Any 4-20mA pressure input reading is above its High Trip setting or out of range
10021/20021	(20)	Read Only	Proof of Closure	Coil		0 = POC A, POC B and POC Up are all closed or disabled
						1 = Any POC input is open
10022/20022	(21)	Read Only	ESD Input	Coil		0 = ESD input is closed
						1 = ESD input is open
10023/20023	(22)	Read Only	Start Input	Coil		0 = Start input is closed
						1 = Start input is open
10024/20024	(23)	Read Only	Low Pressure	Coil		0 = Pressure A, Pressure B and Upstream Pressure 4-20mA input readings are all at or above their Low Trip settings
						1 = Any 4-20mA pressure input reading is below its Low Trip setting or out of range
10025/20025	(24)	Read Only	Flame Detected	Coil		0 = Flame is absent on both burners
						1 = Flame is present on either burner
10026/20026	(25)	Read Only	Flame Test Fail Alarm	Coil		0 = Alarm not set
						1 = Alarm set
10027/20027	(26)	Read Only	Unit Failure Alarm	Coil		0 = Alarm not set
						1 = Alarm set
10028/20028	(27)	Read Only	Low or High Voltage Alarm	Coil		0 = Alarm not set
						1 = Alarm set
10029/20029	(28)	Read Only	High Temperature Alarm	Coil		0 = Alarm not set
						1 = Alarm set
10030/20030	(29)	Read Only	4-20 Alarm	Coil		0 = Alarm not set
						1 = Alarm set
10033/20033	(32)	Read Only	Level Input (Latched)	Coil		Latched version of register 10017/20017
10036/20036	(35)	Read Only	High Pressure Input (Latched)	Coil		Latched version of register 10020/20020
10037/20037	(36)	Read Only	Proof of Closure (Latched)	Coil		Latched version of register 10021/20021
10038/20038	(37)	Read Only	ESD Input (Latched)	Coil		Latched version of register 10022/20022
10039/20039	(38)	Read Only	Start Input (Latched)	Coil		Latched version of register 10023/20023
10040/20040	(39)	Read Only	Low Pressure (Latched)	Coil		Latched version of register 10024/20024
10041/20041	(40)	Read Only	Flame Detected (Latched)	Coil		Latched version of register 10025/20025
10042/20042	(41)	Read Only	Flame Test Fail (Latched)	Coil		Latched version of register 10026/20026
10043/20043	(42)	Read Only	Unit Failure (Latched)	Coil		Latched version of register 10027/20027
10044/20044	(43)	Read Only	Low or High Voltage (Latched)	Coil		Latched version of register 10028/20028
10045/20045	(44)	Read Only	High Temp Alarm (Latched)	Coil		Latched version of register 10029/20029
10046/20046	(45)	Read Only	4-20 Alarm (Latched)	Coil		Latched version of register 10030/20030

Address (Offset)		Read/Write	Name	Type	10x	Range	
30001/40001	(0)	Read Only	Run and Valve Status Bits	Bitset		0b0000 000**0** Run	0 = Not Running 1 = Running
						0b0000 00**0**0 Pilot A	0 = De-energized 1 = Energized
						0b0000 0**0**00 Pilot B	
						0b0000 **0**000 SSV A	
						0b000**0** 0000 SSV B	
						0b00**0**0 0000 SSV Up	
30002/40002	(1)	Read Only	Input Status and Flags	Bitset		0b0000 0000 0000 000**0** Level Input	0 = Closed 1 = Open
						0b0000 0000 0000 00**0**0 Not Used	
						0b0000 0000 0000 0**0**00 Not Used	
						0b0000 0000 0000 **0**000 High Pressure Input	
						0b0000 0000 000**0** 0000 Proof of Closure	
						0b0000 0000 00**0**0 0000 ESD Input	
						0b0000 0000 0**0**00 0000 Start Input	
						0b0000 0000 **0**000 0000 Low Pressure	
						0b0000 000**0** 0000 0000 Flame Detected	0 = No Flame 1 = Flame A or B Detected
						0b0000 00**0**0 0000 0000 Flame Test Fail	0 = Alarm not set 1 = Alarm set
						0b0000 0**0**00 0000 0000 Unit Failure	
						0b0000 **0**000 0000 0000 Low or High Voltage	
						0b000**0** 0000 0000 0000 High Temp Alarm	
						0b00**0**0 0000 0000 0000 4-20 Card Alarm	
30003/40003	(2)	Read Only	Bath 1 Thermocouple Reading	int16		-50°C to 1350°C * Celsius Only	
30004/40004	(3)	Read Only	Bath 2 Thermocouple Reading	int16		-50°C to 1350°C * Celsius Only	
30005/40005	(4)	Read Only	Outlet Thermocouple Reading	int16		-50°C to 1350°C * Celsius Only	
30006/40006	(5)	Read Only	Pilot A Flame Quality	uint16		Pilot A Flame Quality in %	
30007/40007	(6)	Read Only	Input Status and Flags (Latched)	Bitset		Latched version of register 30002/40002 above	
30008/40008	(7)	Read Only	Bath Process Setpoint	uint16		0°C to 1350°C * Celsius Only	
30009/40009	(8)	Read Only	Bath Main Off Setpoint	uint16		0°C to 1350°C * Celsius Only	
30010/40010	(9)	Read Only	Bath Pilot Off Setpoint	uint16		0°C to 1350°C * Celsius Only	
30011/40011	(10)	Read Only	4-20mA Level Reading	uint16		4-20 Level/Flow Input reading	
30012/40012	(11)	Read Only	4-20mA Upstream Pressure	uint16	10x	4-20 Pressure Input reading multiplied by 10	
30014/40014	(13)	Read Only	4-20mA Level/Flow and Upstream Pressure Input Alarms	Bitset		0b0000 000**0** Level Low Alarm	0 = Alarm not set 1 = Alarm set
						0b0000 00**0**0 Level High Alarm	
						0b0000 0**0**00 Pressure Low Alarm	
						0b0000 **0**000 Pressure High Alarm	
						0b000**0** 0000 4-20 Card Failure	
30018/40018	(17)	Read Only	Ambient Board Temp	int16		-100°C to 1350°C * Celsius Only	
30019/40019	(18)	Read Only	Aux 1 Input reading in mA	uint16	10x	0 - 300 (0mA - 30mA)	
30020/40020	(19)	Read Only	Aux 2 Input reading in mA	uint16	10x	0 - 300 (0mA - 30mA)	
30021/40021	(20)	Read Only	UI Clock Seconds	uint16		0 - 59 Seconds	
30022/40022	(21)	Read Only	UI Clock Minutes	uint16		0 - 59 Minutes	
30023/40023	(22)	Read Only	UI Clock Hour	uint16		0 - 23 Hours	
30024/40024	(23)	Read Only	UI Clock Day	uint16		1 - 31 Days	
30025/40025	(24)	Read Only	UI Clock Month	uint16		1 - 12 Months	
30026/40026	(25)	Read Only	UI Clock Year	uint16		2000 - 2099 Years	
30030/40030	(29)	Read Only	System Bundle Firmware Version	uint16		0x**0A**0B: Major version	
						0x0A**0B**: Minor version	
30031/40031	(30)	Read Only	Pilot A Flame Quality	uint16		Pilot A Flame Quality in %	
30101/40101	(100)	R/W	Bath Process Setpoint Change	uint16		0 - 1350 °C * Celsius Only	
* Write must be above the Bath Low Temp Setpoint and Standby Setpoint, and must be at least 1 degree below the Bath Main Off Setpoint. Writing a value below or above these bounds while running will set the register to its lowest or highest allowable value, respectively.							
30102/40102	(101)	R/W	Bath Main Off Setpoint Change	uint16		0 - 1350 °C * Celsius Only	
* Write must be more than 1 degree above the Bath Process Setpoint and below the Bath Pilot Off Setpoint. Writing a value below or above these bounds while running will set the register to its lowest or highest allowable value, respectively.							
30103/40103	(102)	R/W	Bath Pilot Off Setpoint Change	uint16		0 - 1350 °C * Celsius Only	
* Write must be above the Bath Main Off Setpoint and more than 1 degree below the Bath High Temp Setpoint. Writing a value below or above these bounds while running will set the register to its lowest or highest allowable value, respectively.							

3 DOCUMENT REVISION HISTORY

Document Version	Release Date	Applicable BMS Hardware	Applicable UI Hardware	Applicable Firmware
v2.0	16 SEP 2022	v2.3.x / v2.4.x	v2.3.x / v2.4.x	DB 2.0.4
v1.0	13 OCT 2021	v2.3.x	v3.2.x	DB 1.1.0 / DB 1.0.3

3.1 CHANGE SUMMARY

3.1.1 VERSION 2.0

- Updated Temperature setpoint register type to int16 and updated range to support negative setpoints.
- Updated Temperature setpoint register configuration notes.
- Added/updated registers pertaining to new Level/Flow Control Status Contact Mode.
- Added registers pertaining to the Bath Standby Mode feature.
- Added registers pertaining to the independent Level/Flow Input Units feature.
- Added a section to outline supported PF2100 registers.
- Removed restriction notes on Start/Stop registers.
- Updated bitset and array representation for clarity.
- Added Communication Error diagnostic registers to Communication Loss section.
- Replaced text examples with graphics.
- Updated Troubleshooting section to include links to referenced information.
- Updated Aux In Units registers to include Percent O2 option.

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